

SUPPORT FOR THE AMENDMENT

Claim 1 is currently amended.

Claim 2 is canceled without prejudice or disclaimer.

Claims 5-10 are added.

Support for the amendment to claim 1 can be found in claim 2 and the specification at page 5, line 25 through page 6, line 5.

Support for claims 5-10 can be found in the specification at page 7, lines 14-17 and 22-23, page 10, lines 21-27, and Table 1 at page 12, as originally filed.

No new matter has been added by the amendments.

Upon entry of the amendments, claims 1-10 will be pending in the application.

REQUEST FOR RECONSIDERATION

Applicants wish to thank Examiner Fischer for withdrawing the previous rejection, and for the kind and courtesy discussion of the claimed invention with Applicants' representative. At that time, the structure of the claimed composite material, an amendment for further recite the structure of the composite material, and the excellent results demonstrated in Table 1 of the specification were discussed. The following further expands on that discussion with the Examiner.

The rejection of claims 1-4 under 35 U.S.C. § 103(a) as obvious over Takayama (JP 200209643) and further in view of Heishi (US Patent No. 6,974,654), Shemenski (US Patent No. 4,446,198), and the Rubber Technology and Manufacture (RMT) article is respectfully traversed.

The references do not describe or suggest a composite material having a "section of the bonding interface between brass and rubber", in which "1 to 50 needle-like Cu-S-based reaction products having a length L of 10 nm or more and a ratio of the length L to the width W (L/W) of 5 or more are existent based on 1 μ m in the length of the section of the bonding interface." (Amended claim 1).

Takayama generally describes tire manufacturing, in which an "unvulcanized tire W" may be heated "at [a] predetermined temperature (for example, 60-100 degrees C)." (Paragraph [0018] of the electronic translation of the reference). However, as acknowledged by the Examiner, there is no description of a bonding interface between brass and rubber, or the use of a brass-plated material at all. (See present Office Action at page 2, paragraph 2).

Regarding Heishi, Shemenski, and the RMT article, it is noted that the Examiner relies on these references to demonstrate that brass-plating is conventional. However, other than hindsight of the present invention, there is no evidence or suggestion based on the

disclosure of these references to modify Takayama to have a brass-plated material and include the reaction products as presently claimed.

For instance, the Heishi reference generally describes in the “Background of the Invention” that brass plating of a steel cord can be performed, but that plating can also be ineffective depending on where and how the steel cord is actually plated. (See column 1, lines 28-48). Moreover, there is no indication anywhere in the reference that needle-like Cu-S-based reaction products are formed and controlled in the manner presently claimed.

Shemenski generally describes rubber articles reinforced with steel wire in the “Background of the Invention”, in which steel wire is coated with brass. (Column 1, lines 11-13). However, the reference only indicates that “vulcanization temperatures” and “small amounts of iron in brass alloys used to coat steel [wire]” are important factors for the adhesion of rubber to brass. (Column 1, lines 48-50 and column 2, lines 33-37).

The RMT article generally describes brass-plating for bonding rubber to brass at section 10.5.3.1 on page 400. However, the section also recites that “[b]rass-plating is . . . unnecessary.” Moreover, the section indicates that “in order to obtain greater reliability in bonding, the tendency *nowadays* is to use a proprietary cover cement over the brass”, which is in contrast to the manufacturing described in Takayama.

In the present invention, however, needle-like Cu-S-based reaction products are formed at the bonding interface between brass and rubber, such that when the section of the bonding interface between brass and rubber is observed through a transmission electron microscope, 1 to 50 needle-like Cu-S-based reaction products having a length L of 10 nm or more and a ratio of the length L to the width W (L/W) of 5 or more are existent based on 1 μ m in the length of the section of the bonding interface.

In particular, preheating is carried out at 80 to 120°C before vulcanization such that the reaction products are formed, and thus an excellent bonding strength and long term

adhesion is achieved. As shown in Table 1 of the Examples of the present specification, page 12, the bonding strength and adhesion are dependent on the claimed number of reaction products. Table 1 is reproduced below for the Examiner's convenience.

TABLE 1

No.	Preheating time (min)	Number of needle-like Cu--S-based reaction products based on 1 μ m in the length of the bonding interface	Initial adhesion	Long-term adhesion
1	0 (Not preheated)	None	100	100
2	2	0.2	101	103
3	4	1.2	120	122
4	6	2.1	131	130
5	8	3.5	142	141
6	10	5.2	150	150
7	12	15.5	153	151
8	14	22.5	140	142
9	16	32.2	133	131
10	18	45.5	121	120
11	20	53.2	101	99
12	22	64.5	98	100
13	24	72.2	97	98
14	26	80.5	98	99

Regarding the above-results, the present specification recites the following:

A composite material having **1 to 50 needle-like Cu--S-based reaction products** (based on 1 μ m in the length of the interface) has a **bonding strength of 120% or more**, a composite material having 2 to 40 needle-like Cu--S-based reaction products has a bonding strength of 130% or more, and a composite material having 3 to 30 needle-like Cu--S-based reaction products has a bonding strength of 140% or more. Therefore, it can be understood that they have **excellent adhesion to rubber**.

In contrast to these, a composite material having **less than 1 needle-like Cu--S-based reaction product** (No. 2) and a composite material having **more than 50 needle-like Cu--S-based reaction products** (Nos. 11 to 14) have the same or **lower bonding strength** than a composite material obtained without preheating.

(Page 12, lines 1-9 below Table 1, and page 13, lines 1-5). (Emphasis added).

In contrast, in the references discussed above, there is no demonstration of the needle-like Cu--S-based reaction products or evidence that preheating at 80 to 120°C before

Application No. 10/790,019
Reply to Office Action of April 4, 2006

vulcanization would specifically result in 1 to 50 needle-like Cu--S-based reaction products (based on 1 μ m in the length of the interface), such that excellent bonding strength and long term adhesion is achieved.

Therefore, the claimed invention is novel and unobvious in view of the references. Accordingly, withdrawal of the rejection is requested.

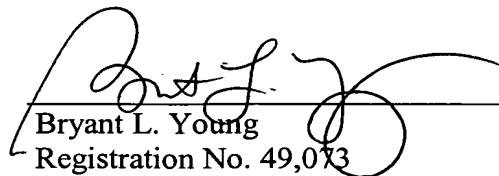
Applicants submit that added claims 5-10 are also novel and unobvious, since these claims depend from amended claim 1 and the cited references do not describe or suggest the features of these claims.

Applicants further submit that the application is now in condition for allowance. Notification of such allowance is earnestly solicited.

Should the Examiner deem that any further action is necessary to place this application in even better form for allowance, the Examiner is encouraged to contact Applicants' undersigned representative at the below listed telephone number.

Respectfully submitted,

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